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L15: Entry 1 of 1 File: USPT May 24, 2005

DOCUMENT-IDENTIFIER: US 6898527 B2
**** See image for Certificate of Correction ****
TITLE: Parking assisting device

Detailed Description Text (30):
The controller 1 sets the initial stop position as a position where the yaw angle of the vehicle is zero degree and simultaneously activates a program for in-line parking based on the operation of the in-line mode switch 4. The driver steers the steering wheel of the vehicle 10 to the maximum rightward to bring it to a fully cut state and advances the vehicle 10 in that state. The controller 1 calculates the yaw angle of the vehicle from the angular speed of the vehicle 10 inputted from the yaw rate sensor 2 and compares this yaw angle with the value of the calculated turning angle .beta.. As the vehicle 10 approaches the vehicle position K1, which is a back start position, from the initial stop position, the controller 1 informs the driver of approach information notifying that the vehicle has approached the vehicle position K1 and arrival information notifying that the vehicle has reached the vehicle position K1 based on the difference between the yaw angle and the calculated turning angle .beta. via the speaker 6.

Detailed Description Text (32):
The driver stops the vehicle 10 in the vehicle position K1 in accordance with the arrival information. Next, the driver steers the steering wheel to the maximum leftward to bring it to a fully cut state and moves the vehicle 10 backward in that state. The controller 1 compares the yaw angle of the vehicle and the value of the calculated turning angle .alpha. (=.beta.+.delta.). As the vehicle 10 approaches the vehicle position L1, which is a steering wheel cutting position, from the vehicle position K1, that is, as the yaw angle of the vehicle approaches the value of the calculated turning angle .alpha., the controller 1 informs the driver of approach information notifying that the vehicle has approached the vehicle position L1 and arrival information notifying that the vehicle has reached the vehicle position L1 based on the difference between the yaw angle and the calculated turning angle .alpha. via the speaker 6.

Detailed Description Text (57):
Thereafter, the driver steers the steering wheel of the vehicle 10 to the maximum leftward to bring it to a fully cut state and moves the vehicle 10 backward in that state. The controller 1 compares the yaw angle of the vehicle to the value of the determined turning angle .gamma., outputs approach information via the speaker 6 when the yaw angle approaches the turning angle .gamma., and further outputs arrival information via the speaker 6 when the yaw angle becomes equal to the turning angle .gamma., judging that the vehicle 10 has reached the steering wheel cutting position Q1.

L17: Entry 1 of 1 File: USPT May 24, 2005

DOCUMENT-IDENTIFIER: US 6898527 B2

**** See image for Certificate of Correction ****

TITLE: Parking assisting device

Abstract Text (1):
When a vehicle advances in parallel with a parking frame to reach an initial stop position, measurement of a distance to a parked vehicle is continuously performed by means of an ultrasonic sensor and a moving distance of the vehicle is simultaneously calculated using a signal from a wheel speed sensor. When actuating an in-line mode switch under a state where the vehicle stops in the initial stop position, a turning angle is calculated so as to enable appropriate in-line parking to the parking frame from an actual initial stop position, based on a deviation of the vehicle from a reference position for the initial stop measured by the ultrasonic sensor. Information on a driving operation that is necessary for back parking is provided to a driver via a speaker based on this turning angle and output from a yaw rate sensor.

Brief Summary Text (10):
A parking assisting device according to the present invention includes: a first distance sensor for measuring a distance to an obstacle on a side of a vehicle; a second distance sensor for measuring a moving distance of the vehicle; yaw angle detecting means for detecting a yaw angle of the vehicle; guiding means for outputting guiding information on a driving operation to a driver; and a controller for grasping an initial stop position based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at a time of an advancing operation of the vehicle until reaching the initial stop position and for providing to the driver via the guiding means appropriate timing for a temporal stop for back parking based on the initial stop position and the yaw angle detected by the yaw angle detecting means.

Brief Summary Text (11):
Note that, it is possible to construct the controller so as to measure a deviation between an actual initial stop position and a reference position for the initial stop based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor and simultaneously to calculate the appropriate timing for the temporal stop for the back parking based on the measured deviation and the yaw angle detected by the yaw angle detecting means.

Brief Summary Text (12):
In this case, the controller may guide via the guiding means the driver to an effect of stopping the vehicle when the controller judges that the vehicle has reached the initial stop position based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position.

Brief Summary Text (14):
Further, it is also possible to construct the controller so as to calculate the appropriate timing for the temporal stop through calculating an inclination of the vehicle with respect to the target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position and adding this inclination to the deviation between the actual initial stop position and the reference position for the initial stop.

Brief Summary Text (15):

Further, it is also possible to construct the controller so as to calculate a suitable initial stop position based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and simultaneously guide via the guiding means the driver to an effect of stopping the vehicle when the controller judges that the vehicle has reached the initial stop position based on the moving distance of the vehicle measured by the second distance sensor.

Brief Summary Text (17):
Further, the controller may calculate the inclination of the vehicle with respect to the target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position, and calculate the suitable initial stop position according to this inclination.

Brief Summary Text (18):
The controller can also store as a history the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor and simultaneously calculate the suitable initial stop position based on this history.

Brief Summary Text (19):
Note that, the controller can also measure a length of the target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position.

Brief Summary Text (21):
It is possible to use an ultrasonic sensor or a sensor using an electromagnetic wave as the first distance sensor, and a wheel speed sensor as the second distance sensor, respectively.

Drawing Description Text (6):
FIG. 5 is a graph showing a measured distance with respect to a position of an ultrasonic sensor in Embodiment 1;

Drawing Description Text (8):
FIG. 7 is a graph showing a measured distance with respect to a position of an ultrasonic sensor in Embodiment 2;

Drawing Description Text (10):
FIG. 9 is a graph showing a relationship between a forward direction distance D ranging from a rear end of a parked vehicle to a front end of a suitable initial stop position and a turning angle .gamma. required thereafter with respect to a vehicle distance B in Embodiment 3;

Detailed Description Text (5):
In addition, the controller 1 is connected with an ultrasonic sensor 7 serving as a first distance sensor for measuring a distance to an obstacle on a side of the vehicle and a wheel speed sensor 8 serving as a second distance sensor for measuring a moving distance of the vehicle. The wheel speed sensor 8 detects rpm of wheels of the vehicle, and can calculate the moving distance of the vehicle based on a signal from the wheel speed sensor 8 by means of the controller 1.

Detailed Description Text (13):
The vehicle position J1 is assumed to be a position where a Y coordinate of a position DR of a driver of the vehicle 10 coincides with the Y coordinate of a rear end 20a of the parked vehicle 20, which is a position in parallel with the parking frame T and a position where the vehicle 10 and the vehicle 20 are spaced apart from each other by a predetermined vehicle distance d. Therefore, coordinates (JOx, JOy) of a rear axle center JO of the vehicle position J1 are unconditionally defined from the relationship between the coordinates of the rear end 20a of the vehicle 20, the position DR of the driver and the rear axle center JO, and the vehicle distance d.

Detailed Description Text (25):
First, as shown in FIG. 3, the vehicle 10 advances straight forward in parallel with the road, namely, in parallel with the target parking frame T, to the vehicle position J1, which is the position where the Y coordinate of the position DR of the driver coincides with the Y coordinate of the rear end 20a of the parked vehicle 20 and the vehicle 10 and the vehicle 20 are spaced

apart from each other by the vehicle distance d, for example, by 50 cm. In this case, while the vehicle 10 advances, measurement of a distance from the vehicle 10 to the obstacle on the side of the vehicle, the parked vehicle 20, for example, is continuously performed by means of the ultrasonic sensor 7 that is installed on the front end side portion of the vehicle. The vehicle 10 gradually approaches the vehicle position J1, and reaches the position where the Y coordinate of the position DR of the driver coincides with the Y coordinate of the rear end 20a of the parked vehicle 20, as shown in FIG. 4.

Detailed Description Text (26):
Here, FIG. 5 shows a measured distance x to the obstacle corresponding to the position of the ultrasonic sensor 7, being accompanied with the vehicle 10 that is advancing. There is not existed a vehicle in the target parking frame T, and thus the measured distance x becomes an extremely large value when the vehicle 10 passes the side of the parking frame T. However, as shown in FIG. 3, when a Y coordinate of the ultrasonic sensor 7 reaches a coordinate y1, which coincides with the Y coordinate of the rear end 20a of the parked vehicle 20, the measured distance x abruptly decreases to be a distance from the ultrasonic sensor 7 to the vehicle 20. The measured distance x in this case can be expressed by a sum of the distance of 50 cm from the vehicle 20, which is a reference position ST for the initial stop, and a deviation dx1 in an x direction.

Detailed Description Text (27):
The controller 1 can recognize that the ultrasonic sensor 7 has arrived at the coordinate y1 based on this abrupt change in the measured distance x. Then, the controller 1 stores a length LD from a front end of the vehicle 10 to the position DR of the driver in advance and monitors a moving distance of the vehicle 10, which was calculated by a signal from the wheel speed sensor 8. When the vehicle 10 has advanced by the distance LD from the point where the ultrasonic sensor 7 reaches the coordinate y1, specific stop sound is emitted for the driver via the speaker 6. The driver stops the vehicle 10 upon hearing this stop sound. As a result, the Y coordinate of the position DR of the driver coincides with the Y coordinate of the rear end 20a of the parked vehicle 20, whereby the position is made to be the initial stop position. The measured distance x obtained by the ultrasonic sensor 7 in this case can be expressed by a sum of the distance of 50 cm from the vehicle 20 serving as the reference position ST for the initial stop and a deviation dx2 in the x direction.

Detailed Description Text (28):
It is difficult to precisely position the vehicle 10 in the reference position ST for the initial stop, and thus the above-mentioned deviations dx1 and dx2 in the x direction are likely to generate. Note that, the deviation dx1 and the deviation dx2 are equal to each other when the vehicle 10 travels in parallel with the parked vehicle 20. However, in a case where the vehicle 10 travels slantly with a certain inclination, the values of the deviations become different from each other. The distance between the coordinates y1 and y2 is the distance LD that is stored in advance in the controller 1. Thus, it is possible to obtain even the inclination of the vehicle 10 in this initial stop position with respect to the reference position ST for the initial stop from the deviations dx1 and dx2 and the distance LD.

Detailed Description Text (30):
The controller 1 sets the initial stop position as a position where the yaw angle of the vehicle is zero degree and simultaneously activates a program for in-line parking based on the operation of the in-line mode switch 4. The driver steers the steering wheel of the vehicle 10 to the maximum rightward to bring it to a fully cut state and advances the vehicle 10 in that state. The controller 1 calculates the yaw angle of the vehicle from the angular speed of the vehicle 10 inputted from the yaw rate sensor 2 and compares this yaw angle with the value of the calculated turning angle .beta.. As the vehicle 10 approaches the vehicle position K1, which is a back start position, from the initial stop position, the controller 1 informs the driver of approach information notifying that the vehicle has approached the vehicle position K1 and arrival information notifying that the vehicle has reached the vehicle position K1 based on the difference between the yaw angle and the calculated turning angle .beta. via the speaker 6.

Detailed Description Text (32):
The driver stops the vehicle 10 in the vehicle position K1 in accordance with the arrival information. Next, the driver steers the steering wheel to the maximum leftward to bring it to a fully cut state and moves the vehicle 10 backward in that state. The controller 1 compares the yaw angle of the vehicle and the value of the calculated turning angle .alpha. (=.beta.+.delta.). As the vehicle 10 approaches the vehicle position L1, which is a steering wheel cutting position, from the vehicle position K1, that is, as the yaw angle of the vehicle approaches the value of the

calculated turning angle .alpha., the controller 1 informs the driver of approach information notifying that the vehicle has approached the vehicle position L1 and arrival information notifying that the vehicle has reached the vehicle position L1 based on the difference between the yaw angle and the calculated turning angle .alpha. via the speaker 6.

Detailed Description Text (36):
First, while the vehicle 10 advances straight forward in parallel with the road from a side of the vehicle 30 that is parked behind the target parking frame T, measurement of a distance to the obstacle on the side of the vehicle is continuously performed by means of the ultrasonic sensor 7. This distance measurement by means of the ultrasonic sensor 7 is continuously performed until the vehicle 10 reaches the initial stop position, that is, until the vehicle 10 reaches the position where the Y coordinate ace of the position DR of the driver coincides with the Y coordinate of the rear end 20a of the parked vehicle 20.

Detailed Description Text (37):
In this case, in accordance with the advancement of vehicle 10, a distance x measured with the ultrasonic sensor 7 is shown in FIG. 7. A distance to the vehicle 30 that is parked behind the parking frame T is measured first. However, a vehicle does not exist after a time when a Y coordinate of the ultrasonic sensor 7 reaches a coordinate y0 which coincides with a Y coordinate of a front end 30a of the parked vehicle 30, and thus the measured distance x becomes an extremely large value. Further, when the Y coordinate of the ultrasonic sensor 7 reaches the coordinate y1 which coincides with the Y coordinate of the rear end 20a of the vehicle 20 that is parked in front of the parking frame T, the measured distance x abruptly decreases to be a distance from the ultrasonic sensor 7 to the vehicle 20. Accordingly, the controller 1 can recognize that the ultrasonic sensor 7 has arrived at the coordinates y0 and y1 based on this abrupt change in the measured distance x, and a distance PSL by which the vehicle 10 has moved during the above-mentioned operation can be calculated using a signal from the wheel speed sensor 8. This distance PSL expresses a length of a parking space formed by the parked vehicles 30 and 20.

Detailed Description Text (38):
After the ultrasonic sensor 7 reaches the coordinate y1, as in Embodiment 1, when the vehicle 10 has advanced by the distance LD and the ultrasonic sensor 7 reaches the coordinate y2, specific stop sound is emitted for the driver via the speaker 6. The driver stops the vehicle 10 upon hearing this stop sound. As a result, the Y coordinate of the position DR of the driver becomes a position which coincides with the Y coordinate of the rear end 20a of the parked vehicle 20, which becomes the initial stop position.

Detailed Description Text (42):
A parking assisting device according to Embodiment 3 has the same construction as the parking assisting device of Embodiment 1 shown in FIG. 1. However, the parking assisting device according to this embodiment is a device provided not for stopping the vehicle in the reference position for the initial stop set in advance, but for guiding the driver an appropriate initial stop position that is calculated by the controller 1 based on a distance x to an obstacle on a side of the vehicle measured by the ultrasonic sensor 7. Further, guiding information is provided to the driver, in which: the vehicle moves backward by bringing the steering angle to the maximum from the initial stop position and the vehicle stops in a steering wheel cutting position; and the vehicle moves backward by bringing the steering angle to the maximum in the opposite direction from the steering wheel cutting position, whereby the vehicle reaches the target parking space.

Detailed Description Text (43):
Description will be made of a calculating method of the suitable initial stop position with reference to FIG. 8. A vehicle distance between the vehicle 10 and the parked vehicle 20 is assumed to be B. When respective widths of these vehicles are assumed to be W2, a distance DX by which the vehicle 10 should be moved in an X direction through a parking operation is represented by the following expression.

Detailed Description Text (45):
Here, the distance DX can be measured by the ultrasonic sensor 7 and the minimum turning radius Rc is known, and thus the turning angle .gamma. can be calculated from the above-mentioned expression.

Detailed Description Text (46):
When the turning angle .gamma. is obtained, a distance DY between positions P0 and R0 of the rear axle center in a Y direction can be obtained by the following expression.

Detailed Description Text (49):
On the other hand, a distance ZC7 between the right rear end Z of the vehicle 20 and a turning center C7 of the vehicle 10 is represented by the following expression using a distance E between the right rear end Z of the vehicle 20 and the turning center C7 of the vehicle 10 in the Y direction.

Detailed Description Text (51):
Therefore, the value of the distance E can be determined by substituting a specific numerical value, for example, 40 cm, for F.

Detailed Description Text (52):
Here, the distance DY was already obtained, and thus a forward distance D from a rear end of the parked vehicle 20 to a front end of the vehicle 10 at the initial stop position P1 is represented by the following expression.

Detailed Description Text (53):
In this manner, the forward distance D can be obtained from the vehicle distance B between the vehicle 10 and the parked vehicle 20.

Detailed Description Text (55):
First, the vehicle 10 advances forward in parallel with a road, and the in-line mode switch 4 is actuated while the vehicle 10 passes the side of the parking space. With this, measurement of a distance to the parked vehicle 20 is continuously performed by means of the ultrasonic sensor 7 installed on the front end side portion of the vehicle 10. In the same manner as that in Embodiment 1, the controller 1 recognizes that the ultrasonic sensor 7 reaches the rear end position of the vehicle 20 and simultaneously measures the vehicle distance B between the vehicle 10 and the vehicle 20. According to the above-mentioned procedure, the forward distance D from the rear end of the vehicle 20 to the front end of the suitable initial stop position P1 and the turning angle .gamma. required thereafter can be determined.

Detailed Description Text (56):
The controller 1 monitors a moving distance of the vehicle 10 calculated using a signal from the wheel speed sensor 8. When the vehicle 10 has advanced by the forward distance D from a point where the ultrasonic sensor 7 reaches the rear end position of the parked vehicle 20, specific stop sound is emitted for the driver via the speaker 6. The driver stops the vehicle 10 upon hearing this stop sound. As a result, the vehicle 10 stops in the suitable initial stop position P1. In this case, the controller 1 resets a yaw angle of the vehicle 10 obtained by the yaw rate sensor 2.

Detailed Description Text (57):
Thereafter, the driver steers the steering wheel of the vehicle 10 to the maximum leftward to bring it to a fully cut state and moves the vehicle 10 backward in that state. The controller 1 compares the yaw angle of the vehicle to the value of the determined turning angle .gamma., outputs approach information via the speaker 6 when the yaw angle approaches the turning angle .gamma., and further outputs arrival information via the speaker 6 when the yaw angle becomes equal to the turning angle .gamma., judging that the vehicle 10 has reached the steering wheel cutting position Q1.

Detailed Description Text (59):
Note that, the relationship of the distance D from the rear end of the parked vehicle 20 to the front end of the suitable initial stop position P1 and the vehicle distance B of the turning angle .gamma. required thereafter is determined based on characteristics of the vehicle 10 as shown in, for example, FIG. 9.

Detailed Description Text (66):
In the actual vehicle 10, as shown in FIG. 11, for example, when a horizontal distance obtained upon detecting a rear end of the parked vehicle 20 by means of the ultrasonic sensor 7 installed on the front end side portion of the vehicle 10 is assumed to be A0, a horizontal distance B0 of the vehicle that is in parallel with the vehicle 20 corresponding to this distance A0 is represented by the following expression.

Detailed Description Text (67):
Incidentally, as shown in FIG. 12, for example, the inclination angle .epsilon. is obtained from:

a vehicle distance A1 of the vehicle 10 to the vehicle 20 obtained when the vehicle 10 has advanced by a distance H1 from the point where the ultrasonic sensor 7 detects the rear end of the parked vehicle 20; and a vehicle distance A2 of the vehicle 10 to the vehicle 20 obtained when the vehicle 10 has further advanced by a distance H2, which is represented by the following expression.

Detailed Description Text (68):
Next, as shown in FIG. 13, in a graph showing a relationship between the forward distance D with respect to the vehicle distance B and the turning angle .gamma., it is possible to obtain a suitable forward distance Da for a case where the vehicle 10 is replaced by the vehicle that is in parallel with the parked vehicle 20 based on an intersection point of a solid line of the inclination .epsilon. extending from a point of the vehicle distance B0 when the forward distance D is 0 with a curve representing the forward distance D. Further, a suitable turning angle .gamma. a can be obtained based on an intersection point of a solid line that is drawn in parallel with a Y axis from the intersection point of the solid line of the inclination .epsilon. with the curve representing the forward distance D with the curve representing the turning angle .gamma..

Detailed Description Text (71):
It can be considered that the vehicle inclined by the angle .epsilon. positions being separated backward by the above-mentioned Y direction displacement .DELTA.Y1f from the vehicle in parallel with the parked vehicle 20. Thus, the vehicle may move in a Y direction by a distance, which is obtained by subtracting the Y direction displacement .DELTA.Y1f from the forward distance Da, and may move in an inclined direction of the angle .epsilon. by a distance D1, which is represented by the following expression.

Detailed Description Text (75):
Therefore, in Embodiment 3, in a case where it is judged that the direction in which the vehicle advances straight forward toward the initial stop position inclines by the angle.epsilon. with respect to the parked vehicle 20, guiding information may be outputted to the driver so as to stop the vehicle 10 when the vehicle has advanced slantly by the above-mentioned distance D1 from the point where the ultrasonic sensor 7 reaches the rear end position of the parked vehicle 20; again stop the vehicle when the vehicle has moved backward by the angle .gamma. 1 from the initial stop position with the steering wheel steered at the maximum leftward; and complete the parking when the vehicle has moved backward by the angle .gamma. a with the steering wheel cut at the maximum rightward.

Detailed Description Text (77):
It is desirable that a correction be performed for the measurement of the vehicle distance to the parked vehicle 20 by the ultrasonic sensor 7 according to an influence caused by a curve in a corner of the vehicle and characteristics of the sensor.

Detailed Description Text (78):
Further, the description has been made of the case where the distance D1 and the angle .gamma.1 are obtained geometrically; however, it may also be possible to calculate those analytically.

Detailed Description Text (80):
Instead of the above-mentioned Embodiments 3 and 4 in which the distance to the parked vehicle 20 starts to be measured by actuating the in-line mode switch 4 while the vehicle 10 passes the side of the parking space, the initial stop position is calculated in Embodiment 5 by constantly performing a measurement of a distance to the obstacle on the side of the vehicle by means of the ultrasonic sensor 7 and a measurement of a traveling distance of the vehicle by means of the wheel speed sensor 8, storing the distance to the obstacle on the side of the vehicle according to the traveling distance as a history, and using this history for the calculation.

Detailed Description Text (81):
The controller 1 constantly actuates the ultrasonic sensor 7 and the wheel speed sensor 8, and stores as a history the distance to the obstacle on the side of the vehicle according to the traveling distance for a past predetermined amount of time or predetermined traveling distance based on a signal inputted from these sensors.

Detailed Description Text (82):
The vehicle 10 stops on the side of the parked vehicle 20 by passing the side of the parking space in the same manner as it does in the initial stop position of Embodiments 3 and 4, for example, and the in-line mode switch 4 is actuated. In this manner, the controller 1 calculates an

appropriate initial stop position for in-line parking in the parking space through the calculation method described in Embodiment 3 or 4, based on the history of the distance to the obstacle on the side of the vehicle according to the traveling distance for the predetermined amount of time or the predetermined traveling distance before the stop of the vehicle.

Detailed Description Text (84):
However, in a case where the initial stop position can not be calculated using only the history stored in the controller 1, the controller 1 further guides the driver to advance the vehicle straight forward or to move the vehicle straight backward via the speaker 6 and adds to the stored history a relationship between the traveling distance and the distance to the obstacle obtained during the above-mentioned operation, to thereby calculate the initial stop position. Thereafter, the controller 1 guides the driver to cause the vehicle to reach the initial stop position by advancing the vehicle straight forward or moving the vehicle straight backward via the speaker 6.

Detailed Description Text (89):
FIG. 14 shows a parking assisting device according to Embodiment 6. The parking assisting device according to Embodiment 6 is, in the device of Embodiment 1 shown in FIG. 1, installed on a front end side portion of the vehicle with an optical sensor 9 as the first distance sensor instead of the ultrasonic sensor 7 for measuring a distance to the obstacle on the side of the vehicle.

Detailed Description Text (96):
As described above, according to the present invention, the first distance sensor measures the distance to the obstacle on the side of the vehicle and simultaneously the second distance sensor measures the moving distance of the vehicle at the time of the advancing operation of the vehicle until reaching the initial stop position, and the controller grasps the initial stop position based on those measured distances and provides to the driver via the guiding means the appropriate timing for the temporal stop for the back parking based on the initial stop position and the yaw angle detected by the yaw angle detecting means. As a result, it is possible to accurately guide the driver the driving operation upon parking without imposing a large burden on the driver even if the vehicle is not accurately stopped in the reference position for the initial stop set in advance.

CLAIMS:

1. A parking assisting device comprising: a first distance sensor for measuring a distance to an obstacle on a side of a vehicle; a second distance sensor for measuring a moving distance of the vehicle; yaw angle detecting means for detecting a yaw angle of the vehicle; guiding means for outputting guiding information on a driving operation to a driver; and a controller for grasping an initial stop position based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at a time of an advancing operation of the vehicle until reaching the initial stop position, for calculating a track for back parking as two circular arcs having predetermined radii respectively which are circumscribed to each other based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor, and for providing to the driver via the guiding means a steering wheel cutting position based on an angle corresponding to a point in which the two circular arcs are circumscribed and the yaw angle detected by the yaw angle detecting means.

2. A parking assisting device according to claim 1, wherein the controller calculates a suitable initial stop position based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and simultaneously guides via the guiding means the driver to an effect of stopping the vehicle when the controller judges that the vehicle has reached the initial stop position based on the moving distance of the vehicle measured by the second distance sensor.

4. A parking assisting device according to claim 2, wherein the controller stores as a history the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor and simultaneously calculates the suitable initial stop position based on this history.

5. A parking assisting device according to claim 1, wherein the controller measures a length of the target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position.

6. A parking assisting device according to claim 1, wherein the first distance sensor is an ultrasonic sensor.

7. A parking assisting device according to claim 1, wherein the first distance sensor is a sensor using an electromagnetic wave.

8. A parking assisting device according to claim 1, wherein the second distance sensor is a wheel speed sensor.

11. A parking assisting device comprising: a first distance sensor for measuring a distance to an obstacle on a side of a vehicle; a second distance sensor for measuring a moving distance of the vehicle; yaw angle detecting means for detecting a yaw angle of the vehicle; guiding means for outputting guiding information on a driving operation to a driver; and a controller for measuring a deviation between an actual initial stop position and a reference position for an initial stop based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at a time of an advancing operation of the vehicle until reaching the initial stop position and for providing to the driver, via the guiding means, appropriate timing for a temporal stop for back parking based on the measured deviation and the yaw angle detected by the yaw angle detecting means.

12. A parking assisting device according to claim 11, wherein the controller guides via the guiding means the driver to an effect of stopping the vehicle when the controller judges that the vehicle has reached the initial stop position based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position.

14. A parking assisting device according to claim 11, wherein the controller calculates an inclination of the vehicle with respect to the target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at the time of the advancing operation of the vehicle until reaching the initial stop position, and adds this inclination to the deviation between the actual initial stop position and the reference position for the initial stop.

15. A parking assisting device comprising: a first distance sensor for measuring a distance to an obstacle on a side of a vehicle; a second distance sensor for measuring a moving distance of the vehicle; yaw angle detecting means for detecting a yaw angle of the vehicle; guiding means for outputting guiding information on a driving operation to a driver; and a controller for calculating the inclination of the vehicle with respect to a target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor at a time of an advancing operation of the vehicle until reaching the initial stop position, for calculating a suitable initial stop position according to this inclination, and for providing to the driver via the guiding means appropriate timing for a temporal stop for back parking based on the initial stop position and the yaw angle detected by the yaw angle detecting means.

16. A parking assisting device comprising: a first distance sensor for measuring a distance to an obstacle on a side of a vehicle; a second distance sensor for measuring a moving distance of the vehicle; yaw angle detecting means for detecting a yaw angle of the vehicle; guiding means for outputting guiding information on a driving operation to a driver; and a controller for grasping a relationship among positions of the vehicle, the obstacle and a target parking space based on the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor while the vehicle passes a side of the target parking space and for providing to the driver, via the guiding means, appropriate information on a driving operation based on an initial stop position and the yaw angle detected by the yaw angle detecting means, the controller storing as a history the distance to the obstacle on the side of the vehicle measured by the first distance sensor and the moving distance of the vehicle measured by the second distance sensor and emitting a warning to the driver in a case where interference of the vehicle with the obstacle, upon parking, is predicted based on the history.

Refine Search

Search Results -

Terms	Documents
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Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Search: L17

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Recall Text Clear Interrupt

Search History

DATE: Monday, November 07, 2005 Printable Copy Create Case

Set Name side by side	Query	Hit Count	Set Name result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L17	l15 and L16	1	L17
L16	distance	2677875	L16
L15	l12 and L14	1	L15
L14	6898527.pn.	2	L14
L13	l11 and L12	0	L13
L12	compar$4	3317936	L12
L11	l9 and L10	1	L11
L10	yaw adj2 sensor	3987	L10
L9	l1 and L8	1	L9
L8	steer$ near4 sensor	18478	L8
L7	l5 and L6	1	L7
L6	steer$	317545	L6
L5	l1 and L4	1	L5
L4	calculat$ same yaw	4384	L4
L3	l1 and L2	2	L3
L2	calculat$	1624482	L2
L1	(6898527 6704653).pn.	5	L1

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Freeform Search

Database:
US Pre-Grant Publication Full-Text Database
US Patents Full-Text Database
US OCR Full-Text Database
EPO Abstracts Database
JPO Abstracts Database
Derwent World Patents Index
IBM Technical Disclosure Bulletins

Term: l1 and L4

Display: 50 **Documents in Display Format:** fro **Starting with Number** 1

Generate: ○ Hit List ◉ Hit Count ○ Side by Side ○ Image

Search Clear Interrupt

Search History

DATE: Monday, November 07, 2005 Printable Copy Create Case

Set Name side by side	**Query**	**Hit Count**	**Set Name** result set
DB=PGPB,USPT,USOC,EPAB,JPAB,DWPI,TDBD; PLUR=YES; OP=OR			
L5	l1 and L4	1	L5
L4	calculat$ same yaw	4384	L4
L3	l1 and L2	2	L3
L2	calculat$	1624482	L2
L1	(6898527 6704653).pn.	5	L1

END OF SEARCH HISTORY